Optimizing dividend policy of Oil and Gas Companies Subject to Capital Structure

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Abstract

This article substantiates the necessity for improving approaches towards optimization of a dividend policy of oil and gas companies. Therefore, this research develops a new conceptual ap-proach in the theory of corporate management aiming at substantiating the feasibility for considering a dividend structure factor of a company, while maximizing the company's market value. A quantitative measurement of the level of optimum dividend payouts that are differentiated according to the compa-ny's capital structure is an advantage of this approach. A functional dependence of the company's market value against the level of dividend payouts, with regard to the company's capital structure, has been pre-sented. A range of quantitative levels of dividend payouts of oil and gas companies under consideration has been calculated, and a type of the optimum policy regarding the established company's capital struc-ture has been determined, in accordance with such range. Such approach allows for substantiating the most effective type of the dividend policy subject to the financial condition of the company for maximiz-ing its market value. It utilizes the subjectivity in the course of optimizing the company's dividend policy and ensures accurate evaluation of the optimum level of dividend payouts. It facilities increasing efficien-cy of the net profit of oil and gas companies under consideration and building capacity of the market val-ue of such companies.

2. Material and Methods.

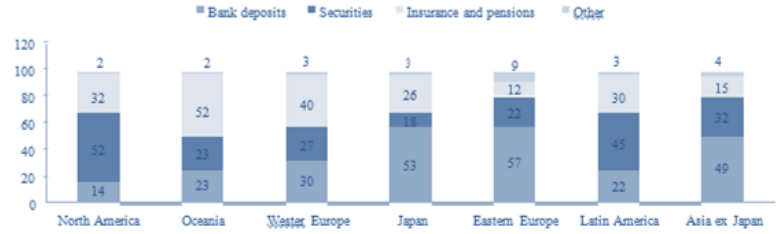
The study branch. Securities are a top-priority investment field in the global financial environment. Despite the fact that global investment is rather differentiated with respect to world regions (see Figure 1), over 39% of the global monetary capital is invested in the securities (The Statistics Portal, 2015), among which approximately a fourth is shareholders' capital. Thus, global investment volume in shares is

marked by a small amount of growth for the last ten years and steady domination in the global invest-ment capital structure (see Figure 2).

Shares of oil and gas companies that are issued by most capitalized and financially stable companies are among highly profitable and least risky investment instruments in the world. The stability of dividend payouts by oil and gas companies ensures a stable demand of the shares and a high level of their liquidity, and, consequently, maximized the market value of the companies. As at 2014, the largest rela-tive share of dividend payout - 3.7% and the highest level of market value of companies - 6.2% were tak-en solely by shares of oil and gas companies among 100 most capitalized companies of the world (PwC, 2015).

Nevertheless, according to data against the geopolitical crisis, oil and gas companies became the most vulnerable spot of energy-dependable countries of the world (Bäuerle and Jaśkiewicz, 2015). A fall in world oil prices gave rise to a negative trend of the level of net profit of most companies in 2014 (see Figure 3), and approximately 50% in the industry on average (Bloomberg, 2015). These circumstances caused a decrease in the level of paid-out dividends of the companies, which, in its turn, lead to a signifi-cant decrease of their market value.

Figure 1 | Share of priorities of financial investing, broken down by world regions as at 2014 [%]



Source: Brandmeir et al., 2015. Financial Markets, 2015.

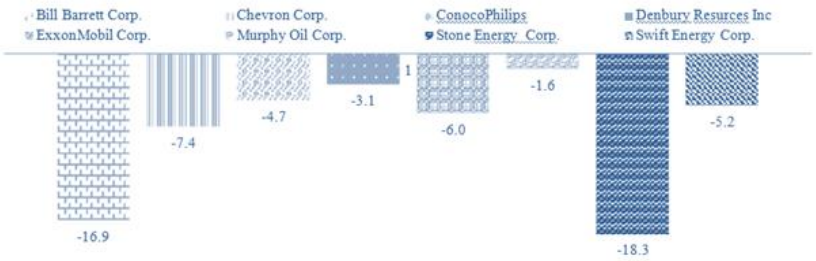
Figure 2| Dynamic structure of financial assets of the global stock market [trillion USD]

Source: The Statistics Portal, 2015.

Such circumstances predetermine the necessity of search for solutions to optimize the dividend poli-cy of the oil and gas companies

with regard to the available capital structure for increasing their market value. Therefore, this research aims at developing an approach to quantitative determination of the op-timum dividend level subject to the capital structure of a company.

Figure 3| Negative change of net profit of a number of oil and gas companies for 2013-2014



Source: The Statistics Portal, 2015. Own calculations.

3.Data and Methodology

The basis of the dividend policy of any company is maximizing its market value, with the dividend policy and capital structure being its factors (Kaźmierska-Jóźwiak, 2015). As long as this article aims at optimizing the dividend policy with regard to the capital structure of a company, financial indicators, such as: equity-assets ratio as an indicator of the capital structure of the company;

level of dividend payouts as an indicator of the volume of dividend payouts per share of the compa-ny; and

average market capitalization of the company as an indicator of the effective dividend policy of the company have been taken as analytical indicators.

Financial statements of eight international oil and gas companies, such as: Bill Barrett Corporation; Chevron Corporation; Conoco Phillips Company; Denbury Resources Inc.; Exxon Mobil Corporation; Murphy Oil Corporation; Stone Energy Corporation; Swift Energy Company served as a statistical basis for this research. The choice of these companies is justified by the instability of payout of dividends on their own shares, but by the high ROE at the same time. In view of the recent trends, these companies are also marked by a decrease in the net profit and market value, which itself determines the necessity to raise efficiency of their dividend policy (see Annex 1).

The dependence of the market value of a company on the level of dividend payouts, with regard to the capital structure of the company, was built up, using a polynomial regressive model. This model is a type

of non-linear modeling and appears to be the following (Nizametdinov and Rumiantsev, 2012):

$f(x) = bo + b1x1n + b2x1n-1+...+bix1 + bi+1x2n + bi+2x2n-1+... +bjx2+...+bmxk,$ (2.1)

where $f(x)$ – an n-power function of the polynomial regressive model;

$x1,...,k$ - independent variables;

bo - a constant term;

$b1,...,i,...,j,...,m$ - coefficients at independent variables; and

$1 < < j < m.$

Parameters of the regression model are estimated, using a least square method. This method relies on fitting parameters of the model, with minimized sum of squared deviations of actual values of a dependent variable fromthe predicted values (Nizametdinov and Rumiantsev, 2012):

$\sum(yi - fi(x))2 \rightarrow min,$ (2.2)

where x- independent variables;

yi - actual value of a dependent value to the i-period;

$fi(x)$ - predicted value of a dependent value to the i-period; and

$i = 1,2, ... , N.$

The range of values of dividend payouts of a company for determining a corresponding type of the dividend policy was determined, using a multidimensional scaling method according to the Fibonacci's Law. This approach implies a proportional division of a section of data values in parts in the following proportion (Vorobiev, 1978):)

$a: b = b: c$

$\{ = a + b ,$ (2.3)

$a < b < c$

According to the presented proportions, changes of data levels occur in ratio of 38.2% × 61.8%. Then, indicator level value ranges are determined by a system (Vorobiev, 1978):

$xmin \leq \leq x1$

$x1 = x$

$x1 < x \leq x2$

$x2 < x \leq xmax$

$+ 0.38 (xmax - x)$ (2.4)

$min \quad min$

$\{x2 = xmi + 0.62 (xmax - xmin)$

where xmin ≤ x ≤ x1 – a range of low values of x indicator;

x1 < x ≤ x2– a range of medium values of x indicator; and

x2 < x ≤ xmax– a range of high values of x indicator.

In order to confirm data about the level of dividend payouts of oil and gas companies, which were obtained by means of the polynomial regression modeling, neural modeling technologies were applied.

An artificial neural network is a mathematic model, featuring a system of simple processors (artifi-cial neurons) and interconnections between them that are defined by weighing coefficients (Borovikov, 2008).

A neural network of a multi-layer perceptron type consists of the following:

a layer of input neurons that receive and encode a signal from the external environment;

a layer of interneurons that constitute the basis of neural networks and serve as the medium for necessary transformations of a modeled system; and

a layer of output neurons with their output values to present effects of the neural network.

Principle of operation of the artificial neuron is as follows. The neuron receives input signals that pass through a connection (synapse) with their intensity corresponding to the synaptic activity of the neuron. The current state of the neuron is determined by a post- synaptic potential function, which is cal-culated as a weighted total of inputs with regard to the threshold value. The post-synaptic system is line-ar for the multi-layer perceptron neural network (Borovikov, 2008).

$netj = wo + \sum N$

$xiwij$, (2.5)

where etj – a post-synaptic function;

wo - the threshold value of the function;

xi – an input signal of the i-th neuron;

wij - weight of the synaptic connection between the i-th neuron and the j-th neu-ron;

and

$i, j = 1,2, \dots, N$.

Obtained value of the PSP-function is transformed via an output signal activation function (Borovikov, 2008):

$yj = f(netj)$, (2.6) where yj – an output signal; and

$f(netj)$ - an activation function.

Liner, logistic, hyperbolic, exponential, sine, piecewise linear or step function is used in neural networks, depending on the nature of interaction between the neurons.

Results

The efficiency of dividend policy depends on the capital structure and financial ca-pabilities of a company, which predefined the market value of the company (Bäuerle and Jaśkiewicz, 2015; Mori and Ikeda, 2015). Therefore, a polynomial regression model of the market value of a company that reflects the dependence of firm's capitalization on the level of dividend payouts, subordinate to the capital structure has been developed. An average annual capitalization of oil and gas companies under consideration is a dependent variable, and the level of dividend payouts and equity-assets ratio for 2010-2014 are dependent variables. As long as statistical indicators are expressed in different units of measurement (Annex 1), data have been priorly standardized for developing the model. Visualization of dependencies of standardized variables of international oil and gas companies under consideration for 2010-2014 has been presented in Figure 4.

Figure 4. Indicators of dependence of market value of oil and gas companies under consideration on equity-assets ration and dividend payouts for 2010-2014 (standardized values)

Source: Own calculations

The dependence of the market value of a company on the level of dividend payouts with regard to the capital structure was revealed in the research using linear modeling. Model coefficients have been determined according to an error level minimization crite-rion (p-level) and comparison of actual values of the Student's t-test (see Table 1).

Table 1 | Indicators of statistical significance of a model of dependence of market value of a company on the level of dividend layout, with regard to the differentiated capi-tal structure

Model	t-value	p-level
b0	-2.34	0.0098
b1	2.54	0.0073
b2	3.01	0.0018
b3	-4.03	0.0003
b4	-3.96	0.0004
b5	-2.11	0.0256
b6	2.73	0.0039
b7	-3.58	0.0006
b8	-4.01	0.0003
b9	4.13	0.0002
b10	4.86	0.0000

Based on the obtained model coefficients, the 5-power polynominal has been deter-mined to be the model of highest statistical significance.

$$\boldsymbol{b0} * Rea + \boldsymbol{b1} * Rea\boldsymbol{4} + \boldsymbol{b2} * Rea\boldsymbol{3} + \boldsymbol{b3} * Rea\boldsymbol{2} + \boldsymbol{b4} * Rea + \boldsymbol{b5} * Ldp\boldsymbol{5} + \boldsymbol{b6} *$$

$$Ldp\mathbf{4} + \boldsymbol{b}\mathbf{7} * Ldp\mathbf{3} + \boldsymbol{b}\mathbf{8} * Ldp\mathbf{2} + \boldsymbol{b}\mathbf{9} * Ldp + \boldsymbol{b}\mathbf{10} \quad (3.1)$$

Thus and so, the polynomial regression model of market value of Russian oil and gas companies that represents the dependence of capitalization of a company on the level of dividend payouts, with regard to the differentiated capital structure (equation 2.1; 2.1) appears to be the following:

$$f = -0.3387 * Rea5 + 0.2427 * Rea4 + 1.1955 * Rea3 - 0.8716 * Rea2 - 0.4322 * Rea - 0.1069 * Ldp5 + 0.6058 * Ldp4 - 0.6178 * Ldp3 - 1.0598 * Ldp + 1.2974 * Ldp + 0.2990, \quad (3.2)$$

where f – a function of dependence of market value of a company on the level of div-idend payouts and capital structure;

Rea - a standardized value of an equity-assets ratio that defines the capital structure of a company;

Ldp - a standardized value of a level of dividend payouts of a company. As long as any value of the p-level does not exceed 0.05 for all model coefficients, and calculated value of the t-test does not exceed the table value in modulus (2.08), one can speak of adequacy of the model that has been developed within this research.

Determining optimum level of dividend payouts subject to the capital structure of a company against maximization of its value

The target of optimization of the dividend policy of a company is determination of such a level of dividend payouts to minimize the market value of the company, as has been pointed out many times before. Therefore, an optimization model for the market value of Russian oil and gas companies that reflects the dependence of capitalization of the firm on the level of dividend payouts and capital structure has been presented in the following way:

$$f\ (Rea; Ldp) = -0{,}3387 * Rea5 + 0{,}2427 * Rea4 + 1{,}1955 * Rea3 - 0{,}8716 * Rea2 - 0{,}4322 * Rea - 0{,}1069 * Ldp5 + 0{,}6058 * Ldp4 - 0{,}6178 * Ldp3 - 1{,}0598 * Ldp2 + 1{,}2974 * Ldp + 0{,}2990 \rightarrow \infty \quad (3.3)$$

While solving the optimization task, based on the developed model and by means of differentiating the capital structure of a company (equity-assets ratio), a level of dividend payouts has been calculated with the model go to infinity, i.e. the market value of the companies go to the maximum value (see Figure 5). For differentiating the capital struc-ture, traditional levels of the correlation between borrowed and equity capital (20/80, 30/70, 40/60, 50/50, 60/40, 70/30, 80/20) have been taken, with regard to maximum and minimum values for international oil and gas companies under consideration for 2010- 2014.

Determining optimum type of dividend policy of a company, with regard to the dif-ferentiated capital structure

Calculation data obtained on the optimum level of dividend payouts of oil and gas companies under consideration that are differentiated according to the capital structure, were the basis for determining the optimum type of dividend policy of the companies. To determine quantitative levels of various types of dividend policy within the research, the Fibonacci's Law was applied. The level of dividend payouts (coefficient) is specified as a value in the range of [0;1]. Based on the Fibonacci sequence, three ranges of levels of dividend layouts (see Equation 2.3; 2.4) that correspond to the determined type of dividend policy of the company (conservative, moderate, aggressive) have been calculated (see Table 2).

Table 2 | Quantitative criteria of a type of dividend policy subject to the level of divi-dend payouts of a company

Range of values of level of dividend	Type of dividend
[0; 0.38]	Conservative
[0.39; 0.62]	Moderate
[0.63; 1]	Aggressive

Range of values of level of dividend payouts

Type of dividend policy. Source: Own calculations

Conservative dividend policy is a type of dividend policy with primary satisfaction of investment needs of a company, and dividends are paid out in a minimum stable amount or according to the residual principle (Akyildiri et al., 2014).

Compromise (moderate) dividend policy is a kind of dividend policy providing for a stable level of dividend payout, including a premium at certain periods. This policy is most associated with the financial performance of the company and the level of satisfac-tion of investment needs of the company (Florackisa et al., 2015).

Aggressive dividend policy is a kind of dividend policy, providing for a stable level of dividend payout, including an 'aggressive' premium at certain periods for market stock 'promoting' of the company. This policy is least associated with the financial per-formance of the company (Ro, 2014).

Based on the quantitative criteria of a type of dividend policy subject to the level of dividend payouts of a company, types of optimum dividend company have been deter-mined in accordance with the capital structure of the company (see Table 3).

Table 3 | Optimum type of dividend policy subject to capital structure of a company

	Capital structure

	2	30	4	5	6	7	8
Type of dividend policy	Aggressive	Aggressive	Aggressive	Moderate	Moderate	Conservative	Moderate

Source: Own calculations

In order to verify the reliability of research findings for optimizing the dividend pol-icy of international oil and gas companies under consideration, neural network technol-ogies were used. It has been justified in the process of study, using Statistica SW, that a multi- layer perceptron neural network is optimum for modeling an effective dividend policy of a company. This model is the one that exhibits the lowest levels of learning, control and test errors, as compared to neural networks of other types (see Table 4).

Table 4 | Statistical specification of a neural network for determining optimum divi-dend policy of oil and gas companies under consideration subject to capital structure.

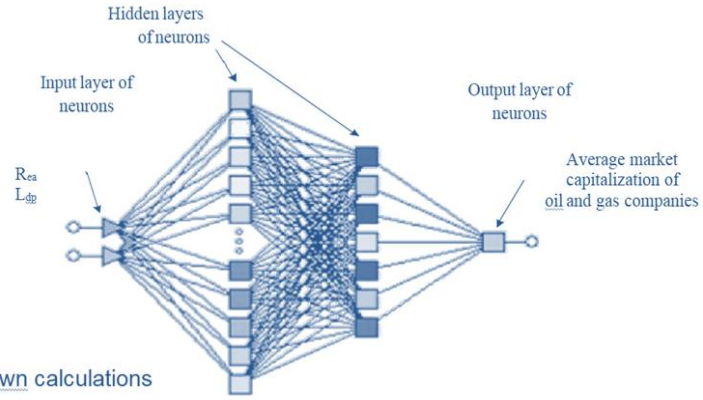
Architecture	Learning	Control error	Test
MP 2:2-29-7-1:1	0.020880	0.036725	0.050123

Architecture Learning error Control error Test error
MP 2:2-29-7-1:1 0.020880 0.036725 0.050123

Source: Own calculations

Low error levels are indicative of the adequacy of the statistical solution with regard to the selected model of a neural network. Visualization of determination of the optimum dividend policy of oil and gas companies under consideration subject to the capital struc-ture and using the neural network has been presented in Figure 6.

Figure 6 | Neural network for determining optimum dividend policy of oil and gas companies under consideration subject to capital structure



Source: Own calculations

The optimum level of dividend payouts and type of company's dividend policy is de-termined, using a multi-layer perceptron neural network for each capital configuration (see Equations 2.5; 2.6) (see Table 5).

Table 5 | Determining the type of optimum dividend policy structure of oil and gas companies under consideration subject to the capital structure and based on neural net-works.

Indicator	Capital structure (correlation between borrowed and						
	20/	30	40/	50	60	7	8
Level of dividend	73%	68%	64%	48%	41%	35%	47%
Type of dividend policy	Aggressive	Aggressive	Aggressive	Moderate	Moderate	Conservative	Moderate

Source: Own calculations

Based on findings of the optimum level of dividend payouts subject to the capital structure of a company, which were obtained by means of non-linear modeling and ap-plication of neural networks, one can point out almost 100% match in the level of divi-dend payouts. This confirms the accuracy and precision of data that were obtained throughout the research.

Thus, one may state that oil and gas companies under consideration must maintain the following proportions of the level of dividend payouts, for optimization of the divi-dend policy:

for the capital structure with the share of equity financial resources no more than 20%, the level of dividend payouts must not exceed 73-75% of the net profit;

with an increase in the equity financial resources from 30% to 40% in the capital structure of the company, the level of dividend payouts should constitute 64% to 68% of the net profit;

if equity financial resources of the company are available in the amount of 50% in the capital structure, the level of dividend payouts must not exceed 45% to 49% of the net profit;

under the conditions of exceedance of equity vs. attracted financial resources in the capital structure within 60%, the target volume of dividend payouts must be 41% of the net profit;

with 70% of the equity capital in the capital structure of a company, the optimum level of dividend payouts is 30% to 35% of the net profit of the company; and

with 80% of the equity capital of the total volume of financial resources of the com-pany, the level of dividend payouts must not exceed 45 to 47%.

Compliance with the proposed ratios of the level of dividend payouts and correla-tion between the equity and attracted capital of oil and gas companies under considera-tion will facilitate growth of their investment attractiveness and market value.

5.Conclusions

Thus, the approach that has been developed within this research is a brand new concept in the paradigm of corporate management. A distinct advantage of this approach is its practical importance, as long as such approach allows for the most accurate deter-mination of the optimum type of dividend policy of oil and gas companies. As opposed to the methods that were presented in theory, this original approach relies on determining the quantitative optimum level of dividend payouts of a company subject to the available capital structure. In its turn, this allows for substantiating the type of optimum corporate policy that corresponds most closely to the current financial condition of the company. The adequacy of using polynomial modeling technologies and neural networks for de-termining the optimum dividend policy proves the accuracy of research findings, which is indicative of the practical importance and value of the developed approach. It facili-tates obtaining objective and reliable data regarding the optimization of dividend policy of oil and gas companies under consideration. It utilizes the subjectivity

and pragmatism of qualitative approaches to maximizing the market value of a company.

The conceptual approach to determining the optimum level of dividend policy of companies that has been developed throughout the research is the basis for improving theoretical and methodological grounds of corporative management. It is described by the simplicity and versatility of its application, as long as it is not limited by regional and industrial attachment of the company. It facilitated justified determination of priorities of dividend payouts, capital structure proportions and development of an effective strategy to maximize the market value of companies against the unstable functionality of the global economy.

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